

REMARKS

The following remarks are provided in response to the final Office action mailed November 24, 2006 in which the Examiner:

- rejected claims 14-17 under 35 U.S.C. §103(a) as being unpatentable over KR 2001055915 to Yang (hereinafter Yang) in view of EP 0843348 to Xia et al. (hereinafter Xia) and further in view of EP 1139403 to Germann et al. (hereinafter Germann).
- rejected claims 18 and 19 under 35 U.S.C. §103(a) as being unpatentable over Yang in view of Xia.

The Applicants respectfully request reconsideration of the above referenced patent application for the following reasons:

Claims 14-17 rejection under 35 U.S.C. §103(a)

The Examiner rejected claims 14-17 under 35 U.S.C. §103(a) as being unpatentable over Yang in view of Xia and further in view of Germann. The Applicants herein amend independent claim 14, upon which claims 15-17 depend, and respectfully request reconsideration of claims 14-17 in view of the amendments and the following arguments.

In claims 14-17, the Applicants teach and claim a method of forming an insulating film on a substrate to reduce nitride consumption during manufacture. The method comprises placing a substrate having a nitride layer thereon in a reaction chamber. A silicon source, an oxygen source, a boron source and a phosphorous source are then

provided for chemical vapor depositing a doped silicate glass layer over the nitride layer. Prior to mixing the flows of the silicon, oxygen, boron and phosphorous sources, the flows are individually stabilized. The silicon source, the oxygen source and the boron source are then injected into the chamber for a predetermined period of time to form a borosilicate glass layer over the nitride layer on the substrate. Finally, the phosphorous source is injected into the chamber while injection of the silicon, oxygen and boron sources into the chamber is continued in order to deposit a borophosphosilicate glass layer over the borosilicate glass layer. That is, **the Applicants teach and claim a method comprising individually stabilizing the flows of the silicon, oxygen, boron and phosphorous sources prior to mixing.** By stabilizing the individual flows prior to mixing, the conditions used to deposit the borophosphosilicate film can be selected to prevent reaction of the nitride layer with phosphorous from the borophosphosilicate film (*see* paragraphs [0050]-[0052] and [0055]).

The Examiner relies on Germann to disclose delaying introduction of the source gases into the chamber until their flows stabilize (Office Action dated November 24, 2006; page 5, final paragraph). However, Germann fails to disclose a method comprising stabilizing source flows prior to mixing the source flows. Germann does disclose bypassing a reactor with a mixture of gases until the mixture of gases stabilizes (*see* abstract, paragraph [0009]). Nonetheless, Germann is silent with respect to stabilizing individual source flows prior to mixing the individual source flows, as taught and claimed by the applicants. Thus, **Germann discloses stabilizing a mixture of gases**, whereas **the**

Applicants teach and claim individually stabilizing each source flow prior to mixing the source flows.

The Examiner relies on Yang to disclose depositing a BSG film and then depositing a film of BPSG on the BSG layer (Office Action dated November 24, 2006; page 3, final paragraph). The Examiner relies on Xia to disclose using silicon, oxygen, and boron sources to form a BSG layer and using silicon, oxygen, boron and phosphorous sources to form a BPSG layer (Office Action dated November 24, 2006; page 2, second paragraph). Thus none of Germann, Yang nor Xia, alone or in combination, disclose a method comprising individually stabilizing the flows of the silicon, oxygen, boron and phosphorous sources prior to mixing, as taught and claimed by the Applicants.

Claims 18-19 rejection under 35 U.S.C. §103(a)

The Examiner rejected claims 18-19 under 35 U.S.C. §103(a) as being unpatentable over Yang in view of Xia. The Applicants herein amend independent claim 18, upon which claim 19 depends, and respectfully request reconsideration of claims 18-19 in view of the amendments and the following arguments.

In claims 18-19, the Applicants teach and claim a method to control nitride consumption during integrated circuit manufacture. The method comprises first placing a substrate having a nitride layer in a reaction chamber. A silicon source, an oxygen source, a boron source and a phosphorous source are then provided. The silicon, oxygen and boron sources are injected into the reaction chamber while injection of the phosphorous source in the reaction chamber is delayed for a predetermined period of

time. This delay enables first deposition of a boron-rich silicate glass film over the nitride layer. The predetermined period of time is selected relative to the desired nitride layer consumption during a subsequent anneal, wherein the desired nitride layer consumption is at least a portion of the nitride layer. Finally, the phosphorous source is injected into the reaction chamber following the predetermined period of time. Meanwhile, injection of the silicon, oxygen and boron sources into the reaction chamber is continued in order to deposit a borophosphosilicate film over the boron-rich silicate glass film. That is, **the Applicants teach and claim a method comprising targeting a borosilicate glass film deposition time relative to a desired amount of consumption of at least a portion of an underlying nitride layer.**

The Examiner relies on Yang to disclose depositing a BSG film and then depositing a film of BPSG on the BSG layer (Office Action dated November 24, 2006; page 3, final paragraph). Yang fails to disclose a method comprising targeting consumption of at least a portion of a nitride layer underneath a BSG layer. In fact, Yang teaches away from targeting consumption of at least a portion of a nitride layer because Yang discloses preventing the nitride layer from being etched altogether (*see* Patent Viewer translated version of Yang). Thus, **Yang discloses preventing altogether the etching of a nitride layer**, whereas **the Applicants teach and claim targeting consumption of at least a portion of a nitride layer.**

The Examiner relies on Xia to disclose using silicon, oxygen, and boron sources to form a BSG layer and using silicon, oxygen, boron and phosphorous sources to form a BPSG layer (Office Action dated November 24, 2006; page 2, second paragraph). Thus

neither Yang nor Xia, alone or in combination, disclose a method comprising targeting a borosilicate glass film deposition time relative to a desired amount of consumption of at least a portion of an underlying nitride layer, as taught and claimed by the Applicants.

New claims 23-32

New claim 23 depends from independent claim 18. In light of the amendments made to claim 18, the Applicants respectfully request consideration of new claim 23.

In claims 24-32, the Applicants teach and claim a method comprising placing a substrate having a nitride layer in a reaction chamber. A silicon source, an oxygen source and a boron source are provided into the reaction chamber while provision of a phosphorous source into the reaction chamber is delayed. Thus, a borosilicate glass layer is first formed over the nitride layer. The phosphorous, silicon, oxygen and boron sources are then provided into the reaction chamber to form a borophosphosilicate film over the borosilicate glass layer. The deposition conditions and the thickness of the borophosphosilicate film are selected to prevent reaction of the nitride layer with phosphorous from the borophosphosilicate film. That is, in claims 23-32, the Applicants teach and claim **a method comprising selecting the thickness of, and the conditions used to deposit, a borophosphosilicate film such that reaction of a nitride layer with phosphorous from the borophosphosilicate film is prevented.**

None of Germann, Yang nor Xia, alone or in combination, disclose a method comprising selecting the thickness of, and the conditions used to deposit, a

borophosphosilicate film such that reaction of a nitride layer with phosphorous from the borophosphosilicate film is prevented, as taught and claimed by the Applicants.

CONCLUSION

The Applicants submit that they have overcome the Examiner's claim rejections and that they have the right to claim the invention as set forth in the listed claims. The Examiner is respectfully requested to contact the undersigned by telephone if it is believed that such contact would further the examination of the present application.

Pursuant to 37 C.F.R. 1.136(a)(3), Applicant(s) hereby request and authorize the U.S. Patent and Trademark Office to (1) treat any concurrent or future reply that requires a petition for extension of time as incorporating a petition for extension of time for the appropriate length of time and (2) charge all required fees, including extension of time fees and fees under 37 C.F.R. 1.16 and 1.17, to Deposit Account No. 02-2666.

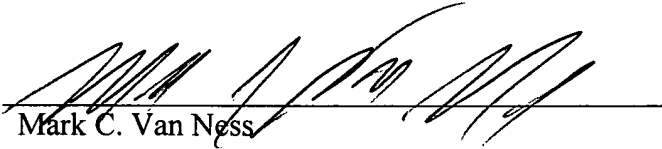
Respectfully submitted,

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Dated

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